A COMPARISON OF GRADUATES FROM DES MOINES TECHNICAL HIGH SCHOOL WITH THOSE STARTING HIGH SCHOOL WITH THEM AND EITHER DROPPING OUT BEFORE GRADUATION OR ENROLLING AT ANOTHER HIGH SCHOOL

A Field Report

Presented to

The Graduate Division

Drake University

In Partial Fulfillment

of the Requirements for the Degree

Master of Science in Education

---

by

Charles S. Greenwood

January 1969

A COMPARISON OF GRADUATES FROM DES MOINES TECHNICAL HIGH SCHOOL WITH THOSE STARTING HIGH SCHOOL WITH THEM AND EITHER DROPPING OUT BEFORE GRADUATION OR ENROLLING AT ANOTHER HIGH SCHOOL

by

Charles S. Greenwood

Approved by Committee:

Chairman

Dean of the Graduate Division

TABLE OF CONTENTS

CHAPTER		PAGE
I.	INTRODUCTION	1
	Statement of the Problem	3
	Limitations	3
	Definitions	4
II.	REVIEW OF THE LITERATURE	7
III.	METHODOLOGY AND RESULTS OBTAINED	17
	The Chi-square Test for Independence	18
	Sex	22
	Race	23
	Location	23
	Grades Earned in Ninth Grade Required Subjects	24
	Choice of Electives in the Ninth Grade	26
	Social-Economic Status	27
	General Aptitude Test Battery	29
IV.	SUMMARY AND CONCLUSIONS	35
	Summary	35
	Conclusions	36
V.	RECOMMENDATIONS	37
BIBLIOGRAPHY		40
APPENDIX A.		44
APPENDIX B.		46

LIST OF TABLES

TABLE		PAGE
I.	September First Enrollments at Des Moines Technical High School For The Years 1964, 1965, 1966, and 1967	2
II.	The Observed and Expected Frequencies of Males and Females in Groups I, II, and III . .	22
III.	The Observed and Expected Frequencies of Caucasians and Non-Caucasians in Groups I, II, and III	23
IV.	The Observed and Expected Frequencies of Location in Groups I, II, and III	24
V.	The Observed and Expected Frequencies of Grades Earned in Required Subjects Taken by Groups I, II, and III in the Ninth Grade	25
VI.	The Observed and Expected Frequencies of the Choice of Electives in the Ninth Grade for Groups I, II, and III	27
VII.	The Observed and Expected Frequencies of Social-Economic Status According to Father's Occupation for Groups I, II, and III	28
VIII.	The Observed and Expected Frequencies of Students in Groups I, II, and III Scoring in the 1st, 2nd, 3rd, and 4th Quartiles of the General Learning Ability Aptitude of the General Aptitude Test Battery	30
IX.	The Observed and Expected Frequencies of Students in Groups I, II, and III Scoring in the 1st, 2nd, 3rd, and 4th Quartiles of the Verbal Aptitude of the General Aptitude Test Battery	31
X.	The Observed and Expected Frequencies of Students in Groups I, II, and III Scoring in the 1st, 2nd, 3rd, and 4th Quartiles of the Numerical Aptitude of the General Aptitude Test Battery	31

TABLE PAGE

XI. The Observed and Expected Frequencies of Students in Groups I, II, and III Scoring in the 1st, 2nd, 3rd, and 4th Quartiles of the Spatial Aptitude of the General Aptitude Test Battery 32

XII. The Observed and Expected Frequencies of Students in Groups I, II, and III Scoring in the 1st, 2nd, 3rd, and 4th Quartiles of the Form Perception of the General Aptitude Test Battery 32

XIII. The Observed and Expected Frequencies of Students in Groups I, II, and III Scoring in the 1st, 2nd, 3rd, and 4th Quarties of the Clerical Perception Aptitude of the General Aptitude Test Battery 33

XIV. The Observed and Expected Frequencies of Students in Groups I, II, and III Scoring in the 1st, 2nd, 3rd, and 4th Quartiles of The Motor Coordination Aptitude of the General Aptitude Test Battery 33

XV. The Observed and Expected Frequencies of Students in Groups I, II, and III Scoring In the 1st, 2nd, 3rd, and 4th Quartiles of the Finger Dexterity Aptitude of the General Aptitude Test Battery 34

XVI. The Observed and Expected Frequencies of Students in Groups I, II, and III Scoring in the 1st, 2nd, 3rd, and 4th Quartiles of the Manual Dexterity Aptitude of the General Aptitude Test Battery 34

CHAPTER I

INTRODUCTION

Des Moines Technical High School is a comprehensive high school housing tenth, eleventh, and twelfth grade students. It is a former airplane parts production factory located on the west edge of the downtown Des Moines business district. The gymnasium, auditorium, swimming pool, and facilities for KDPS Radio and KDPS-TV Educational Television are housed in an addition to the main plant. School district administrative offices are also located in this building.

Besides the usual required subjects, Des Moines Technical High School also offers a college preparatory curriculum and electives in the fields of art, electronics, auto repair, data processing, metal shop, wood shop, printing, office co-op, and distributive education. The bulk of the non-required curriculum is largely vocationally oriented. The school also offers a full complement of extra-curricular activities including band, drama, chorus, athletics, and debate.

This school has never experienced maximum-capacity enrollment and in 1964 it reached a peak student body figure of just over 2,000. However, since that time enrollment has declined, and the highest enrollment reached in the 1967-1968 school year was 1,654 students. Table I shows the enrollment figures at the beginning of the school years 1964 through 1967, and the per cent of decrease based on the enrollment for the

previous year.

TABLE I

SEPTEMBER FIRST ENROLLMENTS AT DES MOINES TECHNICAL HIGH SCHOOL FOR THE YEARS 1964, 1965, 1966, and 1967

Year	Enrollment	Index of Change
1964	2,031	-----
1965	1,922	-5.4%
1966	1,795	-6.6%
1967	1,654	-7.9%

The mean annual decrease in enrollment for the four years in Table I is 6.6%. In addition to this decline in enrollment, this school is also experiencing a high incidence of students dropping out and students transferring back to the high school in their particular locality in the city. It is hoped that this study will help Des Moines Technical High School officials gain some insight into the reasons for this decline in enrollment and the high dropout and transfer rates at this school.

This study includes students who were a part of, or would have been a part of the Des Moines Technical High School graduating class of 1968. There were 620 original entries in this group. They came from every Des Moines junior high school as well as from suburban areas. Of these, 170, or 27.4% dropped out of school before graduation and 99, or 15.9% transferred to high schools nearer their places of residence.

The purpose of this study was to examine certain pertinent data relating to those students who: (1) graduated, (2) left before graduating, or (3) transferred to schools in their local districts, to see if the obtained data would enable the investigator to discover patterns for the various decisions made by the students enrolled in this school.

I. STATEMENT OF THE PROBLEM

This is a study of the similarities and differences among a selected number of students who were graduated from Des Moines Technical High School and two other groups: (1) the same number of students who enrolled in this school and did not complete their training (known as dropouts) and (2) the same number of students who enrolled in this school and transferred to another high school in their locale.

An attempt will be made to determine whether or not any pattern or patterns will emerge that might help Des Moines Technical High School administrators and the Des Moines Board of Education identify students at the ninth grade level who are most likely to enroll and succeed at Des Moines Technical High School.

II. LIMITATIONS

This study was limited to those students who were enrolled as sophomores at Des Moines Technical High School in the Fall of 1965 and those students who joined them from school districts outside Des Moines or other Des Moines schools

before they graduated in the Spring of 1968. It is further limited to a random sampling from the total population of this group.

All the data for this report were gathered from the cumulative records of individual students on file in the offices of Des Moines Technical High School. It is assumed that these data were entered correctly on these records and that it was copied correctly from them for use in this report.

An adding machine was used in the calculation of the statistics in this report and it is assumed the investigator did the statistical work correctly.

Analysis of the statistical data gathered for this study was limited to the chi-square test for independence. A more detailed explanation of the chi-square test is given in Chapter III of this report. The level of significance used was .05. No further analysis was given any of the data compiled and conclusions were limited to determining whether or not the particular statistic being studied was significant at the .05 level or below.

No investigation was made into the reasons for students dropping out of, or transferring from Des Moines Technical High School, nor was any follow-up study attempted to see if any of the dropouts returned to high school at a later date.

III. DEFINITIONS

Cumulative record. A record of pertinent data kept for each student in the Des Moines public schools containing such

items of information as home address, parent's occupations, various standardized test scores, all grades received, and participation in extra-curricular activities.

Dropout. A student who is officially entered as a student at Des Moines Technical High School and subsequently withdraws for any reason other than re-entry into another high school.

Dropout record. A record of all students who discontinue their enrollment at Des Moines Technical High School kept by the Vice-Principal or the Girl's Advisor. This record shows the date of withdrawal, the reason or reasons given for withdrawal, and any follow-up information that might eventually come back to this school.

General Aptitude Test Battery. A battery of aptitude tests published by the United States Department of Labor and designed to measure students in nine separate aptitudes. A definition of these nine aptitudes is given in Appendix B. This battery of tests is given to students in the Des Moines Public Schools in the first semester of the ninth grade.

Graduate. A student who enrolled at Des Moines Technical High School and remained there to graduate in the normal time of three years.

Transfer record. A record of all students who transfer from Des Moines Technical High School to any other high school showing the date of withdrawal, reason or reasons for withdrawal, and the destination of the student.

Transfer student. A student who withdraws from Des Moines

Technical High School to re-enroll in another high school in the Des Moines metropolitan area.

CHAPTER II

REVIEW OF THE LITERATURE

The vocational-technical high school as it is known today is a very essential part of the total system of American education. In the early days of our country trades and skills were learned by people in apprenticeships that were practiced totally within the framework of industry. As the need for more skilled workers and craftsmen grew so did the industrial demands for young people to be trained in the various skills and crafts.

Richard J. Storr, writing "The Growth of American Education" in the book Education and Economic Development, edited by Anderson and Bowman, pointed out that in the early 1800's masters began to realize that their charges were very much in need of a more rounded education, hence, the establishment of evening schools for the teaching of mathematics, science, literature, and social studies. From these evening schools stemmed instruction aimed at teaching, or bettering skills in the various trades.[1]

In the past half century, under the increasingly complex organization of industrial society, the responsibility

---

[1]C. Arnold Anderson and Mary Jean Bowman, Education and Economic Development (Chicago: Aldine Publishing Company, 1963), pp. 130-141.

for much of the vocational preparation has been transferred to the public school system.

Vocational education is a task which the high schools themselves did not originally seek. However, as the concept of the comprehensive high school developed and educators became increasingly aware of the need to educate for living, the challenge of incorporating into curriculum programs training for vocational proficiency as well as general cultural education was met. The fact that general and vocational education should not and cannot be separated in an effective program for the individual student, inevitably means that the agency responsible for conducting the one must conduct the other phase of the educational service.

Vocational education, like all other forms of education, is an individual matter in so far as the learning process is concerned, but society as a whole has a most important stake in the enterprise. Patricia Cayo Sexton reported in her book, Education and Income, that fifty per cent of the top ten per cent of high school graduates do not go to college and are likely to be found on an assembly line shortly after graduation. An industrial society such as ours, if it is to grow at top speed, should call on the full intellectual potential of ALL the people.[1]

In a report from the Association for Supervision and

---

[1]Patricia Cayo Sexton, Education and Income (New York: The Viking Press, 1961), pp. xvii-xviii.

Curriculum Development Commission on the Education of Adolescents prepared for the National Education Association by Kimball Wiles and Franklin Patterson it was stated that the American high school must provide youth with experiences which continuously increase the personal, social, and vocational competencies needed in society. This report inferred that the high school graduate should possess the skills and knowledge that would enable him to support himself and contribute to the economic development of the nation.[1]

Mary Jean Bowman, in Education and Economic Development, agreed that on-the-job training is a necessary factor in the basic education of any society, and there are many things that people learn most efficiently when the teaching is linked to work experience.[2]

The need for the pursuit of vocational activities in our system of education is obvious. It is generally recognized by authorities on education that not all our youth are mentally and economically prepared to spend four, five, or six years of their lives in institutions of higher learning. It is also generally recognized that many students become victims of our society's push to prepare each and every one of our high school students for continued education and

---

[1]Kimball Wiles and Franklin Patterson, The High School We Need, A report from the ASCD Commission on the Education of Adolescents (Washington: National Education Assoc., 1959), p. 2.

[2]Anderson, op. cit., pp. 98-129

become dropouts because of the frustrations and anxieties fostered by this pressure.

James B. Conant, in his book The American High School Today, suggested that there is less tendency for a high school student committed to a vocational course of study to waste time or develop a negative attitude toward his schoolwork.[1]

In its report, Public Education and the Future of America, the Educational Policies Commission of the National Education Association reported that the American economy is predicated upon a broad foundation of public education. This report stated:

> This education begins with the literacy which enables a man to read directions and be alert to danger warnings. It reaches into the whole range of basic skills in operating the tools and machinery essential to the production and distribution of goods. It involves comprehension by the individual of his role in the economic process, requires the identification and cultivation of managerial abilities, and extends into the cherishing of effective human relations. Of crucial concern to the nation's future is the extent to which education provides Americans with fundamental vocational skills and essential insights into economic processes. Such skills and insights constitute the educational base on which modern industry, agriculture, and commerce rest.[2]

Kimball Wiles, in his book The Changing Curriculum of The American High School, develops two significant points relative to the treatment of vocational education by the public schools. He stated: "Courses used by a student to

---

[1]James B. Conant, The American High School Today (New York: McGraw-Hill Book Company, 1959), p. 127.

[2]National Education Association, Public Education and The Future of America, A Report Prepared by the Educational Policies Commission (Washington: National Education Association, 1955), pp. 88-89.

prepare for an occupation should be considered vocational education," and "Vocational education should be a required part of each pupil's program but planned individually to meet his purposes."[1]

The implication is that it is the use to which the student hopes to put the knowledge that will be the key to helping school officials decide what the objective of the course shall be. A further implication is that the schools will have to take measures to determine why the individual student is taking the course.[2]

Wiles advocated that the vocational offerings of the schools should be many and varied and that no student should be made to choose a specified curriculum. He also maintained that separate schools should not be designed to house those students choosing vocational courses of study.[3]

In assessing the role of the high school in regard to vocational education, the Vocational Education Branch of the Iowa Department of Public Instruction stated that the purpose of the vocational program is twofold. This group suggested that the goals of vocational education are: (1) to prepare the student terminating his education at high school for a specific area of employment and (2) to prepare those contin-

---

[1] Kimball Wiles, The Changing Curriculum of the American High School (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1963), p. 122.

[2] Ibid., p. 123.

[3] Ibid., pp. 124-125.

uing their education beyond high school to succeed in post-high school vocational education programs.[1]

In a report published in 1968, this same branch of the Iowa Department of Public Instruction also stated that programs of vocational education in Iowa should be continued with the aim of working towards a higher level of comprehensiveness. It was suggested in this report that all high schools in the state should work toward the improvement of their non-vocational practical arts programs. It advocated these as essential units of instruction which may lead to assisting students in making vocational choices.

Another paragraph in this same report stated:

> We still have a large percentage of our high school students who do not continue on after high school age with educational programs. Therefore, if we are to assist the student in taking his next step, it is imperative that vocational education be made available if possible in the local high school.[2]

A major problem brought about by the need for vocational education for some of our youth, but not for others, is how to identify the potential vocational student and get him directed into the appropriate school training area. This must be done before the "dropout symptoms" appear. In Guidance and the School Dropout, a book sponsored jointly by the American Personnel and Guidance Association and the

---

[1]Iowa State Department of Public Instruction, A Report Prepared by the Vocational Education Branch, "Role of the High School in Vocational Education" (Des Moines: May 29, 1968), p. 1. (Mimeographed.)

[2]Ibid., p. 1.

National Education Association and published in 1964, Edmund W. Gordon pointed out that the majority of dropouts are from minority groups and children from the lower social-economic strata of our society.[1] This same sentiment is echoed in another National Education Association publication, The School Dropout, also published in 1964.[2] Here are two areas, then, in which one might concentrate his efforts to locate potential dropouts and investigate their potential as vocational students.

Two methods suggested to school systems as ways to cope with the dropout problem and presented in the National Education Association report, The School Dropout, were: (1) operate work-study programs on both junior and senior high school levels and (2) identify potential dropouts early and provide special educational and referral services for them.[3]

Super and Overstreet's book, The Vocational Maturity of Ninth-Grade Boys, gave much insight into the counseling of students in the direction of vocational training. These two authors suggested that the best time to ascertain the anticipatory or actual vocational decisions of students is at the end of junior high school or at the beginning of high school.

---

[1]Daniel Schreiber (ed.), Guidance and the School Dropout (Washington: National Education Association, 1964), pp. 193-195.

[2]Daniel Schreiber (ed.), The School Dropout (Washington: National Education Association, 1964), pp. 84, 86, and 90.

[3]Ibid., p. 139.

This is necessary because so much of our high school curriculum is structured to develop continuity over a period of two or three years.[1]

The most recent study of the dropout problem in the public schools of Iowa was conducted by the Iowa Department of Public Instruction and published in 1964. However, another study was started in 1967, to run through the 1967-1968 school year, but the results of that study were not available at the time of this writing. The 1964 report was called Dropout and revealed the following facts from the President's Committee on Youth Employment, which it made public in 1963:

1. Unemployment among Negro youth is double that of white youth.
2. School dropouts suffer most from unemployment.
3. In the 1960's employment needs for unskilled workers will remain about the same as in the 1950's.[2]

It was also reported in Dropout that 15.8 per cent of all students who enter ninth grade in the State of Iowa drop out of school sometime before graduation.[3]

An analysis of the data that the Iowa Department of Public Instruction gathered from the public schools of this state during the 1963-1964 school year revealed that those who

---

[1]Donald E. Super and Phoebe L. Overstreet, The Vocational Maturity of Ninth-Grade Boys (New York: Columbia University Teachers College, Bureau of Publications, 1960), p. 10.

[2]Iowa State Department of Public Instruction, Dropout (Des Moines, Iowa: State of Iowa, 1964), pp. 1-2.

[3]Ibid., p. 4.

withdrew from high school had a lower grade-point average, had a lower I.Q., and scored lower on the Iowa Tests of Educational Development than did those who stayed in school. Dropouts were also absent from school more while they were enrolled than were those who stayed. Further analysis of this data showed that the "stayers" were from homes of a higher social-economic status than were the dropouts.[1]

During the 1963-1964 school year 7,242 pupils, out of a total enrollment of 607,823 pupils in the public schools in Iowa, dropped out. This was a dropout rate of 1.19 per cent for that year. During that same year the public schools of Polk County, Iowa, experienced a dropout rate of 1.29 per cent. Eighty-eight per cent of all dropouts in Iowa occurred in grades nine through twelve that particular year. Just over four per cent of the total enrollment in each of the grades ten, eleven, and twelve, and approximately two per cent of grade nine were dropouts.[2]

In this report on dropouts in Iowa the State Department of Public Instruction stated:

> At Des Moines Technical High School, a program for the male dropout who has been out of school for at least a year has, as its objective, training the unemployable for entry into the labor market. This project is being totally reimbursed by federal funds. Instruction is provided by regular faculty members and persons in local industry. Enrollees are given orientation programs in four fields, three in shop and one in business. Intensive training is then offered in an

---

[1] Ibid., pp. 4-5.

[2] Ibid., pp. 8-13.

> occupation which the Iowa State Employment Service has found to be under-supplied with workers. Enrollees are paid a stipend equal to unemployment compensation.
>
> Informal evaluation made by counselors during a series of interviews would indicate that sixty to seventy per cent of the enrollees have been making satisfactory progress while the remainder are unlikely to complete the program.[1]

After evaluating its findings as reported in Dropout the State Department of Public Instruction suggests that all people who have an interest in the future of our youth put forth more effort to individualize counseling, especially at the lower grade-levels, develop more materials that would make counseling with the vocationally oriented pupil as effective as that done with the pupil in the college preparatory course of study, and assist the faculty and administration in developing a plan to identify the potential dropout as early as possible.[2]

---

[1] Ibid., p. 31.

[2] Ibid., pp. 32-35.

CHAPTER III

METHODOLOGY AND RESULTS OBTAINED

Data for this study were gathered from the cumulative record files of individual students and the dropout and transfer records maintained at the administrative offices of Des Moines Technical High School. Three separate lists were compiled and sorted into alphabetical order according to the student's last name. One list included the names of all the graduates of this high school. Another list included students who enrolled at this school in the Fall of 1965 and subsequently dropped out of school, and the third list included all students who enrolled at this school in the Fall of 1965 and later transferred voluntarily to another high school in the Des Moines metropolitan area. Students in each list were numbered consecutively beginning with number one. Fifty subjects were then picked from each list by random sample employing a table of random numbers from Edward's book Experimental Design In Psychological Research.[1]

The cumulative record for each of the 150 students was examined and the following items of information were recorded: sex, race, location of residence, father's occupation, percentile scores on all phases of the General Aptitude Test

---

[1]Allen L. Edwards, Experimental Design in Psychological Research (New York: Holt, Rinehart, and Winston, 1962), pp.332-6.

Battery, grades earned in ninth grade required subjects, and electives chosen by the student in the ninth grade. This information was then categorized and tabulated and the chi-square test for independence was applied to it.

The chi-square test for independence. The chi-square test for independence is one method to determine whether or not two variables are related. Table II of this study contains data concerning the sex of the three groups of students being studied. The importance of these data in regard to this study is whether or not there is any relationship between the student's sex and his, or her, belonging to either Group I, Group II, or Group III.

The chi-square test for independence can be outlined briefly in four steps:

1. Calculating the expected cell frequencies
2. Calculating the chi-square value of the table on the basis of the observed and expected frequencies
3. Calculating the number of degrees of freedom
4. Determining the critical value of chi-square at the pre-determined level of significance and comparing it with the chi-square value of the table

The basis for Table II is the raw data which shows the number of males and the number of females observed in each of the three groups. The chi-square test for independence assumes that there is no relationship between the variables in this table. The first step in the chi-square test is to answer the question, "Based on the raw data available, what

frequencies should be expected in each cell of the table?" The expected frequencies for each cell are found by multiplying the total of the row containing that particular cell by the total of the column containing that cell and dividing by the total population of all three groups. Expected frequencies in Table II, and in all succeeding tables in this report, are found in parenthesis to the right of the observed frequencies.

After finding the expected frequencies for each cell of a table, it is then possible to calculate the chi-square value of that table. The chi-square value is found by subtracting the expected frequencies from the observed frequencies (or vice-versa, depending upon which number is larger) and finding the square of the difference. This product is then divided by the expected frequencies. The quotient obtained, and the quotients for each remaining cell of the table, calculated in a like manner, are added together, the sum being the chi-square value of the table.

To illustrate the use of the chi-square formula as applied to Table II of this report, the number of males in all three groups, 91, was multiplied by the number of students in Group I, 50. The product, 4,551, was then divided by the total number of people in all three groups, 150. The quotient was 30.3. This represents the number of expected frequencies in the cell "Male - Group I" and since the same totals were involved in the other two columns of this table, 30.3 represents the expected frequencies for each cell in the

"Male" row. The difference between the expected and observed frequencies of males in Group I was 6.3, in Group II the difference was 2.3, and in Group III the difference was 8.7. The squares of these numbers were added together and divided by the expected frequency for males produced a chi-square value for this row of four. The same procedure was used for the "Female" row and a chi-square value of 6.1 was produced. These two values added together equaled 10.1, which represents the chi-square value of Table II.

More careful analysis of Table II would reveal that after finding the observed and expected frequencies of the cell, "Male - Group I", and the cell, "Male - Group II", one would simply have to subtract the total of either the observed or the expected frequencies of these two cells from 91 to get the observed or the expected frequencies for the cell, "Male - Group III." Likewise, the observed and expected frequencies for each cell in the "Female" row could be found by subtracting either the observed or the expected frequencies in the corresponding column of the "Male" row from the total number of students in each group. Thus, by finding the observed and the expected frequencies of only two cells in Table II, the observed and expected frequencies of the rest of the cells in that table can be found by the simple process of subtraction. Table II, then, has "two degrees of freedom", statistically speaking. The degrees of freedom of any table can be found by taking the number of rows, minus one, times the

number of columns, minus one. For example, a six-by-three table, such as Table IV in this report, would have ten degrees of freedom.

For the purposes of this report the level of significance accepted as adequate to retain the hypothesis that variables tested are related was .05. The chi-square value of Table II was 10.1. Examination of a table of critical values of chi-square shows that the value of chi-square at the .05 level for a table with two degrees of freedom is 5.991.[1] Thus, the hypothesis that the sex of a student is a variable independent of whether or not he graduated from, dropped out of, or transferred from Des Moines Technical High School was rejected. In other words, based on the data available in Table II the hypothesis of independence was rejected. In fact, in the case of Table II, the chi-square value of the data shows a relationship between the variables significant at the .01 level.

The chi-square test for independence is a test to enable one to decide if there is a significant relationship between variables. It does not tell one to what extent one variable depends upon the other. If the chi-square value of any given table in this report should be less than the chi-square value of that table at the .05 level according to a table of critical values of chi-square, then the hypothesis

---

[1]John E. Freund, Modern Elementary Statistics (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1952), p. 392.

of independence is retained. The variables in that particular table are not dependent upon other variables in that table at the .05 level or below.

Sex. Table II illustrates the observed and expected frequencies of the male and female distribution of Groups I, II, and III. The chi-square value of Table II was 10.1. For a two-by-three table, such as this, chi-square at the .05 level equals 5.991. In this instance the hypothesis of independence was rejected. Further examination of the data in Table II shows that of the enrollees at this school, females are more likely to graduate while males are more likely to drop out or transfer before graduating.

TABLE II

THE OBSERVED AND EXPECTED FREQUENCIES OF MALES AND FEMALES IN GROUPS I, II, AND III

Sex	Group I	Group II	Group III	Total
Male	24 (30.3)	28 (30.3)	39 (30.3)	91
Female	26 (19.7)	22 (19.7)	11 (19.7)	59
Total	50	50	50	150

Race. Caucasian and non-caucasian observed and expected frequencies were tabulated and arranged into a two-by-three table. An entry concerning race was found on the cumulative record for each of the students in this study. Table III shows

the observed and expected frequencies of caucasian and non-caucasian distribution in Groups I, II, and III.

TABLE III

THE OBSERVED AND EXPECTED FREQUENCIES OF CAUCASIANS AND NON-CAUCASIANS IN GROUPS I, II, AND III

Race	Group I	Group II	Group III	Total
Caucasian	41 (40.3)	37 (40.3)	43 (40.3)	121
Non-caucasian	9 (9.7)	13 (9.7)	7 (9.7)	29
Total	50	50	50	150

The resulting chi-square value for these two groups was 2.39. The value of chi-square at the .05 level for a two-by-three table, such as Table III, is 5.99. Thus, the hypothesis of independence was retained.

Location. The city was divided into five geographical areas and another category, "other," was established to include students not living in any one of these five districts. For a description of the geographic boundaries of each of the five districts included in Table IV see Appendix A. Table IV illustrates the observed and expected frequencies of location within and without the city.

TABLE IV

THE OBSERVED AND EXPECTED FREQUENCIES OF LOCATION IN GROUPS I, II, AND III

Location	Group I	Group II	Group III	Total
Northwest	4 (5.7)	8 (5.7)	5 (5.7)	17
North-Central	7 (8.3)	10 (8.3)	8 (8.3)	25
Northeast	15 (17.7)	14 (17.7)	24 (17.7)	53
South-Central	8 (5.7)	7 (5.7)	2 (5.7)	17
Southeast	11 (6.3)	4 (6.3)	4 (6.3)	19
Other	5 (6.3)	7 (6.3)	7 (6.3)	19
Total	50	50	50	150

The chi-square value of Table VI was 14.40. Chi-square at the .05 level for a six-by-three table, such as Table VI, is 15.51, thus, the hypothesis of independence is retained.

Grades earned in ninth grade required subjects. English and social studies are the only subjects required of ninth grade pupils in Des Moines' public schools. When transcripts used in the compilation of these data were from schools outside of Des Moines, only the English and social studies grades were used.

Grading in the public schools of Des Moines is done on a numerical rating scale of 1 through 5, with 1 representing the high end of the scale and 5 being the low.

Table V illustrates the observed and expected frequencies of mean grades received in the ninth grade required

subjects for individuals in Groups I, II, and III. The first category, a grade-average range of from .5 through 2.4, indicates high-average or excellent grades, the second category, 2.5 through 3.4, indicates average grades, and the third category, 3.5 through 5, indicates low-average or failing grades.

The chi-square value of Table V is 11.72. Chi-square at the .05 level for a three-by-three table, such as Table V, was 9.488. Therefore, the hypothesis of independence is rejected. Grades in ninth grade required subjects are, in this case, a significant variable in helping to determine which enrollees at Des Moines Technical High School are likely to finish high school there. Furthermore, analysis of the data in Table V indicated that of the ninth-graders who enrolled at this school, those who maintained the best grade-point average in their ninth grade required subjects were most likely to stay there and graduate.

TABLE V

THE OBSERVED AND EXPECTED FREQUENCIES OF GRADES EARNED IN REQUIRED SUBJECTS TAKEN BY GROUPS I, II, AND III IN THE NINTH GRADE

Mean Grade	Group I	Group II	Group III	Total
.5 - 2.4	13 (8.1)	7 (8.1)	4 (8.1)	24
2.5 - 3.4	23 (19.5)	15 (19.5)	20 (19.5)	58
3.5 - 5.0	14 (22.4)	28 (22.4)	25 (22.4)	67
Total	50	50	49*	149

*No record was available for one of the students in Group III.

Choice of electives in the ninth grade. Junior high schools in the Des Moines School system offer electives in art, music, mathematics, science, general business, foreign language, homemaking and industrial arts. For the purpose of this study the electives were categorized into five separate headings, as illustrated in Table VI. The "other" category was used to report instances where a student came to this city from outside the local school district and had credit recorded on his cumulative record for subject-matter not offered for credit in the junior high schools of Des Moines. Foreign languages were the electives least taken by the students in this study, consequently "other" electives were combined with them. The high occurrence of mathematics andscience resulted from the practice of junior high counselors in the Des Moines schools strongly recommending these subjects to their counselees before they enter high school. Table VI shows the observed and expected frequencies of the electives chosen by the students in Groups I, II, and III in the ninth grade.

The Chi-square value of Table VI was 12.15. Chi-square at the .05 level for a five-by-three table, such as Table Vi, was 15.507, therefore, the hypothesis of independence was retained.

TABLE VI

THE OBSERVED AND EXPECTED FREQUENCIES OF THE CHOICE OF ELECTIVES IN THE NINTH GRADE FOR GROUPS I, II, AND III

Elective	Group I	Group II	Group III	Total
Math-Science	49 (49)	48 (54.8)	48 (41.2)	145
Industrial Arts	12 (15.2)	17 (17)	16 (12.8)	45
Vocational & Homemaking	19 (18.3)	25 (20.4)	10 (15.3)	54
Fine Arts	7 (7.1)	9 (7.9)	5 (6.0)	21
Foreign Lang. and Other	7 (4.4)	6 (4.9)	0 (3.7)	13
Total	94	105	79	278

Social-economic status. In Social Class in America, Warner, Meeker, and Eells listed seven classifications of occupations which they advocated as determiners of one's social-economic status in the American society. These were, ranked from lowest to highest: (1) unskilled workers and laborers, (2) semi-skilled workers, truck drivers, and similar service occupations, (3) small business proprietors and factory workers, (4) skilled workers, including craftsmen and foremen, (5) clerks, including office and sales personnel, (6) semi-professionals, and (7) professionals.[1] These were

[1]W. Lloyd Warner, Marcia Meeker, and Kenneth Eells, Social Class in America (Chicago: Science Research Associates, Inc., 1949), pp. 131-136

combined into four categories for this study because of the low number of occurrences reported on cumulative records in several of the occupational classifications listed on the preceding page. Another category was added to these four to include the unemployed, retired, and those with unknown occupations. Table VII illustrates the observed and expected frequencies of social-economic status according to father's occupation for Groups I, II, and III.

The chi-square value of Table VII was 15.23. Chi-square at the .05 level for a five-by-three table, such as Table VII, was 15.507, thus, the hypothesis of independence was retained.

TABLE VII

THE OBSERVED AND EXPECTED FREQUENCIES OF SOCIAL-ECONOMIC STATUS ACCORDING TO FATHER'S OCCUPATION FOR GROUPS I, II, AND III

Occupation	Group I	Group II	Group III	Total
Professional, semi-professional & clerks	8 (8.7)	9 (8.7)	9 (8.7)	26
Skilled workers	10 (7.7)	6 (7.7)	7 (7.7)	23
Semi-skilled and small business prop.	7 (11)	8 (11)	18 (11)	33
Unskilled and laborers	13 (8.7)	7 (8.7)	6 (8.7)	26
Unemployed, retired and unknown	12 (14)	20 (14)	10 (14)	42
Total	50	50	50	150

General Aptitude Test Battery. The General Aptitude Test Battery published and distributed by the United States Department of Labor, Bureau of Employment Security, is given to most of Des Moines' junior high school students in the first semester of the ninth grade. These tests are not made up by students absent on the day of testing, consequently the various phases of the test taken by the students in this report were not consistent in numbers. More of Group I had scores for all phases of this test recorded on their cumulative records than did Group II or Group III and there were more scores recorded for Group III than for Group II. In some cases there were scores recorded for some phases of the test for a particular student, but no score recorded for other phases.

In each of the Tables from VIII through XVI presented on succeeding pages, the chi-square value of the table is less than chi-square at the .05 level for a four-by-three table and the hypothesis of independence is retained.

The raw scores earned by the students on the various phases of the General Aptitude Test Battery were converted to percentile scores according to a conversion table included within the manual used for administering these tests. These percentile scores were then sorted into the first, second, third, or fourth quartiles, the first quartile encompassing all scores from seventy-six to 100 per cent, the second quartile from fifty-one through seventy-five per cent, the third quartile from twenty-six through fifty per cent, and

the fourth quartile from one through twenty-five per cent.

Chi-square at the .05 level for a four-by-three table, such as all the tables reporting General Aptitude Test Battery scores in this report, was 12.59. The chi-square value for each of the tables is given in the text immediately after the table.

For a brief description of each of the nine phases of the General Aptitude Test Battery see Appendix B.

TABLE VIII

THE OBSERVED AND EXPECTED FREQUENCIES OF STUDENTS IN GROUPS I, II, AND III SCORING IN THE 1st, 2nd, 3rd, AND 4th QUARTILES OF THE GENERAL LEARNING ABILITY APTITUDE OF THE GENERAL APTITUDE TEST BATTERY

Quartile	Group I	Group II	Group III	Total
76% - 100%	9 (6.8)	1 (3.5)	6 (5.7)	16
51% - 75%	12 (11.3)	6 (5.7)	8 (9.3)	26
26% - 50%	11 (13.6)	11 (7.0)	10 (11.4)	32
1% - 25%	5 (5.5)	1 (2.8)	7 (4.5)	13
Total	37	19	31	87

The chi-square value of Table VIII was 8.37, thus, the hypothesis of independence was retained.

TABLE IX

THE OBSERVED AND EXPECTED FREQUENCIES OF STUDENTS IN GROUPS I, II, AND III SCORING IN THE 1st, 2nd, 3rd, AND 4th QUARTILES OF THE VERBAL APTITUDE OF THE GENERAL APTITUDE TEST BATTERY

Quartile	Group I	Group II	Group III	Total
76% - 100%	8 (6.4)	2 (3.3)	5 (5.3)	15
51% - 75%	8 (8.9)	6 (4.6)	7 (7.5)	21
26% - 50%	14 (12.8)	8 (6.6)	8 (10.9)	30
1% - 25%	7 (8.9)	3 (4.6)	11 (7.5)	21
Total	37	19	31	87

The chi-square value of Table IX was 5.16, thus, the hypothesis of independence was retained.

TABLE X

THE OBSERVED AND EXPECTED FREQUENCIES OF STUDENTS IN GROUPS I, II, AND III SCORING IN THE 1st, 2nd, 3rd, AND 4th QUARTILES OF THE NUMERICAL APTITUDE OF THE GENERAL APTITUDE TEST BATTERY

Quartile	Group I	Group II	Group III	Total
76% - 100%	4 (3.0)	1 (1.6)	2 (2.4)	7
51% - 75%	13 (13.1)	8 (6.7)	9 (10.2)	30
26% - 50%	12 (10.9)	6 (5.6)	7 (8.5)	25
1% - 25%	8 (10.0)	4 (5.1)	11 (7.8)	23
Total	37	19	29	85

The chi-square value of Table X was 3.37, thus, the hypothesis of independence was retained.

TABLE XI

THE OBSERVED AND EXPECTED FREQUENCIES OF STUDENTS IN GROUPS I, II, AND III SCORING IN THE 1st, 2nd, 3rd, AND 4th QUARTILES OF THE SPATIAL APTITUDE OF THE GENERAL APTITUDE TEST BATTERY

Quartile	Group I	Group II	Group III	Total
76% - 100%	19 (17.0)	7 (8.7)	14 (14.3)	40
51% - 75%	10 (11.5)	8 (5.9)	9 (9.6)	27
26% - 50%	4 (4.3)	1 (2.2)	5 (3.6)	10
1% - 25%	4 (4.3)	3 (2.2)	3 (3.6)	10
Total	37	19	31	87

The chi-square value of Table XI was 3.19, thus, the hypothesis of independence was retained.

TABLE XII

THE OBSERVED AND EXPECTED FREQUENCIES OF STUDENTS IN GROUPS I, II, AND III SCORING IN THE 1st, 2nd, 3rd, AND 4th QUARTILES OF THE FORM PERCEPTION APTITUDE OF THE GENERAL APTITUDE TEST BATTERY

Quartile	Group I	Group II	Group III	Total
76% - 100%	17 (13.6)	8 (7.0)	7 (11.7)	32
51% - 75%	13 (12.8)	6 (6.6)	11 (10.7)	30
26% - 50%	3 (4.7)	2 (2.4)	6 (3.9)	11
1% - 25%	4 (6.0)	3 (3.1)	7 (5.0)	14
Total	37	18	31	86

The chi-square value of Table XII was 6.01, thus, the hypothesis of independence was retained.

TABLE XIII

THE OBSERVED AND EXPECTED FREQUENCIES OF STUDENTS IN GROUPS I, II, AND III SCORING IN THE 1st, 2nd, 3rd, AND 4th QUARTILES OF THE CLERICAL PERCEPTION APTITUDE OF THE GENERAL APTITUDE TEST BATTERY

Quartile	Group I	Group II	Group III	Total
76% - 100%	18 (13.8)	7 (6.7)	7 (11.5)	32
51% - 75%	8 (7.8)	4 (3.8)	6 (6.5)	18
26% - 50%	10 (13.3)	5 (6.5)	16 (11.2)	31
1% - 25%	1 (2.2)	2 (1.0)	2 (1.8)	5
Total	37	18	31	86

The chi-square value of Table XIII was 8.02, thus, the hypothesis of independence was retained.

TABLE IV

THE OBSERVED AND EXPECTED FREQUENCIES OF STUDENTS IN GROUPS I, II, AND III SCORING IN THE 1st, 2nd, 3rd, AND 4th QUARTILES OF THE MOTOR COORDINATION APTITUDE OF THE GENERAL APTITUDE TEST BATTERY

Quartile	Group I	Group II	Group III	Total
76% - 100%	12 (8.5)	3 (4.1)	5 (7.4)	20
51% - 75%	15 (14.4)	8 (7.0)	11 (12.6)	34
26% - 50%	3 (5.5)	1 (2.7)	9 (4.8)	13
1% - 25%	3 (4.7)	4 (2.3)	4 (4.1)	11
Total	33	16	29	78

The chi-square value of Table XIV was 10.66, thus, the hypothesis of independence was retained.

TABLE XV

THE OBSERVED AND EXPECTED FREQUENCIES OF STUDENTS IN GROUPS I, II, AND III SCORING IN THE 1st, 2nd, 3rd, AND 4th QUARTILES OF THE FINGER DEXTERITY APTITUDE OF THE GENERAL APTITUDE TEST BATTERY

Quartile	Group I	Group II	Group III	Total
76% - 100%	5 (3.8)	0 (2.0)	4 (3.2)	9
51% - 75%	7 (6.8)	3 (3.5)	6 (5.7)	16
26% - 50%	11 (9.3)	5 (4.8)	6 (7.8)	22
1% - 25%	8 (11.0)	8 (5.7)	10 (9.3)	26
Total	31	16	26	73

The chi-square value of Table XV was 5.22, thus, the hypothesis of independence was retained.

TABLE XVI

THE OBSERVED AND EXPECTED FREQUENCIES OF STUDENTS IN GROUPS I, II, AND III SCORING IN THE 1st, 2nd, 3rd, AND 4th QUARTILES OF THE MANUAL DEXTERITY APTITUDE OF THE GENERAL APTITUDE TEST BATTERY

Quartile	Group I	Group II	Group III	Total
76% - 100%	6 (6.0)	2 (3.1)	6 (5.0)	14
51% - 75%	3 (2.5)	2 (1.3)	1 (2.1)	6
26% - 50%	13 (12.3)	8 (6.4)	8 (10.3)	29
1% - 25%	9 (10.2)	4 (5.3)	11 (8.5)	24
Total	31	16	26	73

The chi-square value of Table XVI was 3.82, thus, the hypothesis of independence was retained.

CHAPTER IV

SUMMARY AND CONCLUSIONS

Summary. This study was designed to investigate certain criteria of a sampling of a group of students who enrolled in Des Moines Technical High School as sophomores in the Fall of 1965. The purpose of this investigation was to see if any differences existed among students in that group who stayed and graduated and two other groups: (1) those who dropped out before graduation and (2) those who transferred from this high school to high schools nearer their residence before graduating.

The criteria used in this investigation were sex, race, location of residence, grades earned in ninth grade required subjects, choice of electives in the ninth grade, social-economic status, and the nine phases of the General Aptitude Test Battery. The particular method employed to test these criterion was the chi-square test for independence. This test was applied to each of the fifteen separate characteristics as reported on the student's cumulative record in an effort to determine whether or not there was any relationship between a particular characteristic of the student and his belonging to either the graduates, the dropouts, or the transfers.

It was discovered in this report that only two of the

fifteen criterion studied had any bearing on whether or not a student graduated from, dropped out of, or transferred from Des Moines Technical High School. The chi-square test for independence was rejected in the comparison of a student's sex and his group identification and also in the comparison of the grades he earned in the ninth grade required subjects and his group identification. It was retained in the other thirteen cases.

Conclusions. According to the data in this report there is no relationship between a student's race, location, social-economic status, choice of electives in the ninth grade, or percentile scores on any of the nine phases of the General Aptitude Test Battery and his ultimate graduation or withdrawal from Des Moines Technical High School. However, the investigation did reveal that one's sex might be an indication of whether or not he or she will stay and graduate from this high school. The data gathered and tested in this study indicated that female students who enroll at this high school are more likely to stay and graduate while males are more likely to drop out or transfer.

Another probability revealed by the data in this study was in the area of grades earned by these students in their ninth grade required subjects. These data indicated that those who earned the highest grades in their ninth grade required subjects would be more likely to stay until they graduated from Des Moines Technical High School than those earning average or below average grades.

CHAPTER V

RECOMMENDATIONS

The decline in enrollment at Des Moines Technical High School over the past few years indicates that a more comprehensive study of the situation is needed than was made by this investigator. Several methods of investigation should be employed. A questionnaire administered to those who seem to be vocationally oriented students according to performance on the General Aptitude Test Battery and grades earned in junior high school subjects and who do not choose to attend a vocationally oriented school, such as Des Moines Technical High School, should give some insight into students' reasons for not attending this school. This questionnaire must be developed in such a way as to gain the student's attitudes toward this particular school or this type of school.

Some follow-up studies need to be started to gain insight into the reasons for students transferring away from, and dropping out of this high school. Such techniques as personal interviews and questionnaires properly prepared and administered to gain this information should be employed.

Des Moines school officials might investigate the possibility of appointing citizens committee or a joint citizen-school personnel committee to investigate the reasons for

the declining enrollment at this school.

A stepped-up public relations program needs to be initiated in an effort to raise the community's image of this high school. A good place to start is with the students and the entire staff immediately with the opening of school. The business community should be studied and an effort made to re-evaluate the purposes of this school in relation to commercial enterprises in and around Des Moines.

The General Aptitude Test Battery is a useful tool for school officials to gain a better understanding of the individual student's verbal and mechanical abilities. The results of these tests should be carefully analyzed and students made aware of their scores and what they mean.

Other criteria should be studied on a format similar to the one used in this study to see if there are other areas that might indicate one's preference for, or aptitude for vocational courses of study. These might include the Iowa Tests of Educational Development, grades earned earlier than in ninth grade, and other tests and performances in pre-junior high school years.

Students earning high grades in junior high school subjects should be interrogated verbally or by means of tests so designed to find out their college and vocational aptitudes and desires. Des Moines Technical High School is a comprehensive high school offering a college preparatory course of study. It may offer a better choice of alternatives to that

student who is undecided between college and working after high school than any other high school in the area.

Students today are more mobile than ever before. The automobile is very important to them. Perhaps the acute parking problem at this school discourages many of them from going there. Every effort should be made to determine why student enrollment is decreasing at this school while increasing at most others.

BIBLIOGRAPHY

BIBLIOGRAPHY

A. BOOKS

Anderson, Arnold C. and Mary Jean Bowman. Education and Economic Development. Chicago: Aldine Publishing Company, 1963.

Ashmore, Harry S. The Negro and the Schools. Chapel Hill, N. C.: University of North Carolina Press, 1954.

Conant, James B. The American High School Today. New York: McGraw-Hill Book Company, 1959.

Edwards, Allen L. Experimental Design in Psychological Research. New York: Holt, Rinehart, and Winston, 1962.

Freund, John E. Modern Elementary Statistics. Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1952.

Kahler, Alfred and Ernest Hamburger. Education for an Industrial Age. Ithaca, New York: The Macmillan Company, 1965.

Sexton, Patricia Cayo. Education and Income. New York: The Viking Press, 1961.

Super, Donald E. Vocational Development. New York: Columbia University Teachers College, Bureau of Publications, 1957.

Super, Donald E. and Phoebe L. Overstreet. The Vocational Maturity of Ninth-Grade Boys. New York: Columbia University Teachers College, Bureau of Publications, 1960.

Tanner, Daniel. Schools for Youth. New York: The Macmillan Company, 1965.

Trump, J. Lloyd. Secondary School Curriculum Improvement. Boston: Allyn and Bacon, Inc., 1968.

Warner, W. Lloyd, Marcia Meeker, and Kenneth Eells. Social Class in America. Chicago: Science Research Associates, Inc., 1949.

Wiles, Kimball. The Changing Curriculum of the American High School. Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1963.

Williamson, E. G. Vocational Counseling. New York: McGraw-Hill Book Company, 1965.

B. PERIODICALS

Bunda, Richard and Joseph Mezzano, "A Study of the Effects of a Work Experience Program on Performance of Potential Dropouts," The School Counselor, XV (March, 1968), 272-4.

Hoppock, Robert, "Some Do's for the Use of Occupational Information," The School Counselor, XV (November, 1967), 134.

Wyatt, Windal, "Vocational Technical Education in Our Technological Society," Midland Schools, LXXXII (September-October, 1967), 19.

C. PUBLICATIONS OF THE GOVERNMENT, LEARNED SOCIETIES, AND OTHER ORGANIZATIONS

Iowa State Department of Public Instruction. Dropout. Des Moines, Iowa: State of Iowa, 1964.

Iowa State Department of Public Instruction. "Role of the High School in Vocational Education." A Report of the Vocational Education Branch. Des Moines, Iowa, May 29, 1968. (Mimeographed.)

National Education Association. Public Education and the Future of America. Washington: National Education Association, 1955.

Schreiber, Daniel (ed.). Guidance and the School Dropout. Washington: National Education Association, 1964.

Schreiber, Daniel (ed.). The School Dropout. Washington: National Education Association, 1964.

Wiles, Kimball and Franklin Patterson. The High School We Need. Washington: National Education Association, 1959.

APPENDIXES

APPENDIX A

DEFINITIONS OF THE BOUNDARIES OF THE SIX DISTRICTS IN TABLE IV

Northwest. The northwest district is bounded on the south by Grand Avenue, on the west by the west city limits, on the north by the north city limits, and on the east by Beaver Avenue, southeast from the north city limits to 31st Street, then straight south to Grand Avenue.

North-central. The north-central district is bounded on the south by Grand Avenue, on the west by 31st Street, north to Beaver Avenue, then northwest on Beaver Avenue to the north city limits. It is bounded on the north by the north city limits and on the east by 1st Avenue from the north city limits to the Des Moines River, then along the Des Moines River south to Grand Avenue.

Northeast. The northeast district is bounded on the south by Grand Avenue east to University, then east on University to the east city limits. It is bounded on the west by the entire east boundary of the north-central district and on the north by the north city limits. It is bounded on the east by the east city limits.

South-central. The south-central district is bounded on the south by the south city limits and on the west by Fleur Drive from the south city limits north to Grand Avenue.

It is bounded on the north by Grand Avenue and on the east by the Des Moines River from Grand Avenue south to the Raccoon River, then west to Indianola Avenue, then southeast along Indianola Avenue to the south city limits.

Southeast. The southeast district is bounded on the south by the south city limits, on the west by the entire east boundary of the south-central district, on the north by the entire south boundary of the northeast district, and on the east by the east city limits.

Other. The remaining section (southwest) of the city, and everything outside of the city limits are included in this category.

APPENDIX B

DEFINITIONS OF THE NINE APTITUDES MEASURED BY THE GENERAL APTITUDE TEST BATTERY

G--General learning ability. The ability to "catch on" or understand instructions and underlying principles; the ability to reason and make judgments. Closely related to doing well in school.

V--Verbal aptitude. The ability to understand meaning of words and to use them effectively. The ability to comprehend language, to understand relationships between words and to understand meanings of whole sentences and paragraphs.

S-Spatial aptitude. The ability to think visually of geometric forms and to comprehend the two-dimensional representation of three-dimensional objects. The ability to recognize the relationships resulting from the movement of objects in space.

N--Numerical aptitude. The ability to perform arithmetic operations quickly and accurately.

P--Form perception. The ability to perceive pertinent detail in objects or in pictorial graphic material. The ability to make comparisons and discriminations and see slight differences in shapes and shadings of figures and widths and lengths of lines.

Q--Clerical perception. The ability to perceive pertinent detail in verbal or tabular material. The ability to observe differences in copy, to proofread words and numbers, and to avoid perceptual errors in arithmetic computation.

K--Motor coordination. The ability to coordinate eyes and hands or fingers rapidly and accurately in making precise movements with speed. The ability to make movement response accurately and swiftly.

F--Finger dexterity. The ability to move the fingers, and manipulate small objects with the fingers, rapidly or accurately.

M--Manual dexterity. The ability to move the hands easily and skillfully. The ability to work with the hands in placing and turning motions.